Technical Memorandum
Comments on Appendix A of the Final Screening Level Ecological Risk Assessment
Gulfco Marine Maintenance Superfund Site
Freeport, Texas
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1.0 INTRODUCTION

This Technical Memorandum summarizes EA Engineering, Science, and Technology, Inc.'s technical review comments for Appendix A of the Final Screening Level Ecological Risk Assessment (SLERA) prepared by Pastor, Behling & Wheeler, LLC (PBW) for the Gulfco Marine Maintenance Superfund Site (site), located in Freeport, Texas, and submitted to the U.S. Environmental Protection Agency (EPA) on 10 March 2010. The technical review was conducted to evaluate ProUCL data output provided in Appendix A of the SLERA to assure that this data was accurately generated, complies with guidance, and appropriate conclusions were reached.

Technical review comments pertaining to the evaluation of the ProUCL data are provided in Section 2.0. Section 3.0 provides a summary based on the outcome of the technical review.

2.0 TECHNICAL REVIEW COMMENTS

The evaluation indicates the ProUCL model was not run correctly, and the output results likely resulted in erroneous Upper Confidence Limits of the Means (UCLMs). Specifically, the ProUCL model was run with the assumption that data had nonparametric or normal statistical distributions, but ignored the consideration of other distributions (e.g., lognormal or gamma). Although the model output directed the user to examine other distributions, these were not assessed, and conservative assumptions were generally assumed. This error can be easily corrected by running the ProUCL software using all available statistical distributions.

As an example, Attachment 1 (taken from Appendix A of the SLERA) illustrates the model output for background barium in surface soil. The model output states " *Data follow Appr. Gamma Distribution (0.05); May want to try Gamma UCLs*". Pastor, Behling & Wheeler ignored this recommendation and used the nonparametric 97.5 % Chebyshev (Mean, Sd) UCLM of 902 mg/kg.

Attachment 2 illustrates the ProUCL Version 4.00.04 run for the same data allowing the examination of all statistical distributions, which duplicates the nonparametric 97.5 % Chebyshev (Mean, Sd) UCL of 902 mg/kg. As noted as part of this output, it states "*Potential UCL to Use: Use 95% Approximate Gamma UCL*" at 501 mg/kg. Based on this comparison, when the appropriate distribution is applied, the UCL should have been 501 mg/kg, and not 902 mg/kg.

It is expected that some of the data in all of the ProUCL model runs are actually nonparametric, in which case the proper UCLM has been chosen. However, it is likely that many of UCLMs based on the ProUCL runs shown in Appendix A may be in error because they are based on the wrong distribution.

3.0 SUMMARY

In summary, all available distribution options should have been included in the ProUCL runs shown in Appendix A, and the assumption of nonparametric or normal statistical distributions is not correct.

The use of nonparametric or normal statistics may result in conservative estimates of the Upper Confidence Limit of the Mean (refer to barium example referred to above). Consequently the SLERA conclusions are conservative. It is not necessary to rerun ProUCL for the SLERA. However, the ProUCL program must be used appropriately to select the proper distribution and UCLMs in the Baseline Ecological Risk Assessment (BERA).

Attachment 1: ProUCL Data Output from Gulfco Marine Maintenance Site Final SLERA (Appendix A)

99% KM (Chebyshev) UCL	8.477

Data appear Normal (0.05)
May want to try Normal UCLs

Barium

Number of Valid Observations	10
Number of Distinct Observations	8
Minimum	150
Maximum	1130
Mean	333.1
Median	259
SD	288.1
Variance	82980
Coefficient of Variation	0.865
Skewness	2.844
Mean of log data	5.617
SD of log data	0.571
95% Useful UCLs	
Student's-t UCL	500.1
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL	570.5
95% Modified-t UCL	513.7
Non-Parametric UCLs	
95% CLT UCL	482.9
95% Jackknife UCL	500.1
95% Standard Bootstrap UCL	476.8
95% Bootstrap-t UCL	864.1
95% Hall's Bootstrap UCL	1100
95% Percentile Bootstrap UCL	497.6
95% BCA Bootstrap UCL	584.8
95% Chebyshev(Mean, Sd) UCL	730.2
97.5% Chebyshev(Mean, Sd) UCL	**902**
99% Chebyshev(Mean, Sd) UCL	1239

Output provided in Appendix A is limited to non-parametric statistics

Note: Program refers to gamma distribution; the same distribution found as part of the data evaluation.

Data follow Appr. Gamma Distribution (0.05)
May want to try Gamma UCLs

Benzo(a)anthracene

Total Number of Data	10
Number of Non-Detect Data	9
Number of Detected Data	**1**
Minimum Detected	0.082
Maximum Detected	0.082
Percent Non-Detects	**90.00%**

General UCL Statistics for Full Data Sets

User Selected Options	
From File	WorkSheet_a.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Attachment 2: Data Evaluation Run Using ProUCL Version 4.00.04 (all statistical options)

Barium

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	117	Minimum of Log Data	4.762
Maximum	1130	Maximum of Log Data	7.03
Mean	323	Mean of log Data	5.56
Median	238.5	SD of log Data	0.62
SD	293.3		
Coefficient of Variation	0.908		
Skewness	2.786		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.615	Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	493	95% H-UCL	516.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	578
95% Adjusted-CLT UCL	562.9	97.5% Chebyshev (MVUE) UCL	694.8
95% Modified-t UCL	506.6	99% Chebyshev (MVUE) UCL	924.2

Gamma Distribution Test		Data Distribution
k star (bias corrected)	1.782	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	181.2	
MLE of Mean	323	
MLE of Standard Deviation	241.9	
nu star	35.65	
Approximate Chi Square Value (.05)	22.99	
Adjusted Level of Significance	0.0267	
Adjusted Chi Square Value	21.23	
Anderson-Darling Test Statistic	0.826	
Anderson-Darling 5% Critical Value	0.734	
Kolmogorov-Smirnov Test Statistic	0.248	
Kolmogorov-Smirnov 5% Critical Value	0.269	
Data follow Appr. Gamma Distribution at 5% Significance Level		
Assuming Gamma Distribution		

Nonparametric Statistics	
95% CLT UCL	475.5
95% Jackknife UCL	493
95% Standard Bootstrap UCL	465
95% Bootstrap-t UCL	819.2
95% Hall's Bootstrap UCL	1092
95% Percentile Bootstrap UCL	494.2
95% BCA Bootstrap UCL	536.8
95% Chebyshev(Mean, Sd) UCL	727.3
97.5% Chebyshev(Mean, Sd) UCL	902.2
99% Chebyshev(Mean, Sd) UCL	1246

UCL when limited to non-parametric statistics

95% Approximate Gamma UCL	500.9
95% Adjusted Gamma UCL	542.3
Potential UCL to Use	

Use 95% Approximate Gamma UCL 500.9

Chosen UCL